iJRASET
International Journal For Research in Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 14 **Issue:** V **Month of publication:** May 2026

DOI: https://doi.org/10.22214/ijraset.2026.81772

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International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 14 Issue V May 2026- Available at www.ijraset.com

Accessibility Challenges in UPI-Based Mobile Payment Applications

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Abstract: ***The Unified Payments Interface (UPI) of India handles more than 4.61 billion transactions every month, but its accessibility among users with disabilities, senior citizens and low-literacy users is critically under-investigated. The study in this paper is based on a primary survey of 32 UPI users and a synthesis of four major reference studies. Findings indicate that although 90.6% of the respondents know about the features of accessibility, the proportion of those with a strong belief that UPI apps are built inclusively is only 21.9%. Almost half of them have found themselves confused by having no clear labeling of buttons. Basing on the principles of WCAG 2.0, TAM/UTAUT frameworks, and usability testing of Google Pay, PhonePe and Paytm, we outline the fundamental issues in the design and suggest ten evidence-based solutions to inclusive UPI design.***
Index Terms --- Accessibility, UPI, digital payments, mobile HCI, WCAG, usability, fintech, inclusive design, screen reader, India.

I. INTRODUCTION

The Unified Payments Interface (UPI) developed by the National Payments Corporation of India (NPCI) facilitates over 4.61 billion transactions each month in 202021, 55 percent of all transaction volume in India is digital [8][9]. UPI has revolutionized daily business of hundreds of millions of Indians. Nonetheless, quantifying success in terms of transaction volumes alone is a veil of secrecy covering a more difficult fact: large sections of the population are being left behind in this digital revolution.

World Health Organization estimates that 16 percent of the world population have a disability of some kind and one-third of the total number of visually impaired people in the world reside in India [1]. Toss in 13.8 crore elderly and hundreds of millions of first-time smartphone users, and accessibility is no longer the peripheral issue, but rather a dire need. The design freedom of UPI apps is provided by Third Party App Providers (TPAPs) [7], resulting in different accessibility standards across the ecosystem. Users of screen readers are regularly faced with unlabeled buttons, baffling menus, and images with no text descriptions, which prevents millions of people in India to be part of the digital economy.

The paper is a synthesis of a primary survey of 32 UPI users with the results of four major reference studies [10] Valencia-Arias et al. (2025), [14] Kang (2018), [12] Kawamoto et al. (2023), and [11] Singh et al. (2024) to map the accessibility gap and suggest specific

II. LITERATURE REVIEW

In India, the Unified Payments Interface (UPI) developed by the National Payments Corporation of India (NPCI) handles more than 4.61 billion transactions every month, representing 55 percent of all digital transactions in 202021 [8][9]. UPI has brought a revolution in the daily business of hundreds of millions of Indians. But quantifying success in volume of transactions clouds a more difficult reality: huge layers of the population are being left out of this digital revolution.

A. Mobile Payment Adoption.

The PRISMA-based systematic review of 63 papers on mobile payment adoption by Valencia-Arias et al. (2025) indicated that the number of publications has grown exponentially since 2004 to 2023 [10]. The frameworks that prevail are TAM and UTAUT, the most common studied variables are trust (45 studies), perceived ease of use (36 studies), and perceived usefulness (35 studies). Importantly, accessibility, both device access and connectivity, is specifically noted in the review as a research gap that has not been addressed. This is not an incidental omission, but an essential blind spot in the field conceptualization of digital payment inclusion.

B. Fintech Safety and Ease.

According to Kang (2018), mobile fintech systems have six main requirements convenience, infrastructure, compatibility, mobility, security and simplicity [14]. Biometric authentication (fingerprint, iris) is emphasized as the way to frictionless, convenient security - without PIN dependency by the users with motor difficulties. Kang also predicts the need of the wearables of the future to have audio, haptic, and gesture-based interfaces, which are exactly the interfaces used by users of screen readers nowadays. Accessibility design and the future design merge.

C. Success Factors of the Platform.

Kawamoto et al. (2023) investigated M-Pesa (Kenya), Alipay (China), and Nubank (Brazil), where the authors found flexible organisational structure, network coverage, and complementary service bundling to be drivers of success [12]. The USSD-based design of M-Pesa, which can be used on a simple keypad phone with no internet, allowed it to be adopted by practically everyone. This model shows that the design goal of accessibility and wide coverage is identical, an experience that smartphone-only UPI apps have yet to learn.

D. UPI-Specific Usability

Singh et al. (2024) compared Google Pay, PhonePe, and Paytm using the criteria of WCAG 2.0 against 15 visually impaired participants of the Blind Relief Association, New Delhi [11]. Google Pay scored 93/115 (80.9%), Paytm 87/115 (75.7%), and PhonePe just 65/115 (56.5%). Users experienced Paytm screen reader pronouncing two distinct input fields in a single garbled string; no label on the navigation menu in PhonePe; and one customer took ten minutes to find the Change UPI PIN option. Kameswaran and Muralidhar (2019) identified India city users who are visually impaired who use jugaad methods, such as memorising the whereabouts of buttons, or calling on sighted assistants, simply to effect simple transactions [15].

III. METHODOLOGY

A. Research Design

The research is a mixed-method research. The quantitative part includes a 13-question survey conducted to 32 UPI users in the Ghaziabad-NCR area in March 2026, which includes: (1) user profile and usage patterns; (2) five-point Likert-scale usability perceptions; and (3) accessibility awareness and inclusive design beliefs. A qualitative depth was achieved with an open-ended improvement question. The qualitative element incorporates the four reference studies in Section II and enables the cross validation of the general user perceptions with specialist accessibility results.

B. Participant Profile

Table I summarises demographics of participants. The sample is also young (71.9 percent are between the ages of 18 and 25) and student-based (87.5 percent), which is the characteristic of UPI early-adopters, and aligns with the observation of Wei et al. (2021) that the younger generations in the mobile payment market are the primary drivers of the trend across the world [13]. Importantly, 90.6% are using UPI on a daily basis - these are not beginners but those who are experienced and frequent users.

TABLEI. Survey Participant Demographic Profile

Variable	Category	Count (%)
Age Group	18–25	23 (71.9%)
	26–35	8 (25.0%)
	36–45	1 (3.1%)
Occupation	Student	28 (87.5%)
	Working Professional	4 (12.5%)
UPI Frequency	Daily	29 (90.6%)
	Weekly	2 (6.3%)
	Occasionally	1 (3.1%)

C. Evaluation Framework

The usability and accessibility were evaluated on the basis of the WCAG 2.0 Perceivable-Operable-Understandable (POU) framework [23], and cross-correlated with TAM variables in the literature review. Positive sentiment was categorised as Agree + Strongly Agree; the responses that were neutral or negative were treated as such to determine areas of concern.

IV. SURVEY RESULTS AND ANALYSIS

A. Application Preferences

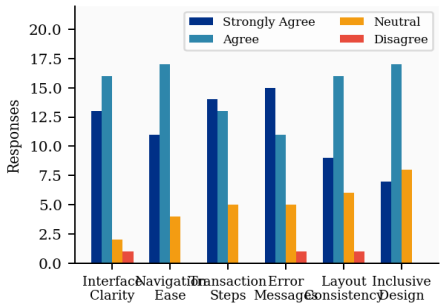
Google Pay was preferred by 50% of respondents (16/32), PhonePe by 31.3% (10), and Paytm by 18.8% (6) — see Figure 1. This is a general following of national UPI. It is also important to note that PhonePe is the national leader in the raw transaction volume but the last in accessibility scores [11], implying that the volumesatisfaction gap may be an accessibility gap to some degree.

Preference of UPI Application Among Survey respondents (n=32)

B. Usability Perception Dimensionally.

Table II and Figure 2 indicate Likert-scale responses in five dimensions of usability. The overall level of satisfaction is average, and the Inclusive Design row is the most indicative: 8 respondents (25%) answered neutrally — that they really do not know whether UPI apps are designed with users with varying abilities. Such a neutral block is representative of the blind-spot of the system that users who solely use their sight to navigate never actually experience the barriers that screen reader users experience everyday.

Fig. 2: Usability Perception Across Constructs (n=32)



Usability Perception Across Constructs — Likert Distribution (n=32)

TABLE II. Full Usability Perception Survey Results (n=32)

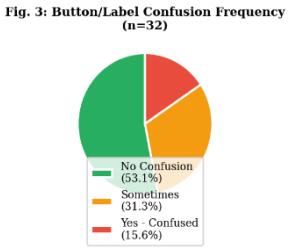
Construct	SA	A	N	D	SD
Interface Clarity	13	16	2	1	0
Navigation Ease	11	17	4	0	0
Transaction Steps	14	13	5	0	0
Error Messages	15	11	5	1	0
Layout Consistency	9	16	6	1	0
Inclusive Design	7	17	8	0	0

SA=Strongly Agree, A=Agree, N=Neutral, D=Disagree, SD=Strongly Disagree.

The most revealing line of the whole table is the Inclusive Design row. Having 7 strong agree, 17 agree, and 8 neutral responses, a quarter of users is truly undecided whether UPI apps are designed to serve individuals with various abilities and requirements. That big neutral block is not merely a lack of awareness, but a very tangible lack of understanding of how users with accessibility issues actually use such places on their day-to-day basis. The failures of the screen reader or unlabeled buttons never happen to most general users as they use the application completely without sight. Their uncertainty is, somehow, a reflection of the systemic blind spot ingrained in the very design of these applications.

C. The Button Confusion Issue.

Figure 3 indicates that the percentage of respondents with no disability (46.9) were confused with ambiguous buttons or labels (Table III). When almost half of digitally experienced sighted users have a problem with labelling, the case of the screen reader users who rely solely on labels is even worse. Singh et al. (2024) recorded the users clicking on each unlabeled button in turn in order to determine its purpose [11].



Button/Label Confusion Frequency (n=32)

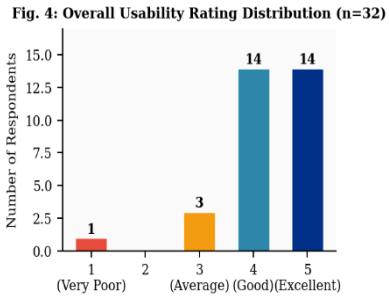
TABLE III. Button and Label Confusion Frequency

Response	Count	Percentage
No Confusion	17	53.1%
Sometimes	10	31.3%
Yes — Confused	5	15.6%
Total with Issues	15	46.9%

There is a lot behind this finding. When close to one-half of the sighted, educated users are puzzled by the labels on the button, the experience of the screen reader users is much worse because they rely solely on the labels. Singh et al. (2024) have recorded the user clicking on each of the unlabeled buttons sequentially in order to determine its purpose [11].

D. Overall Usability Ratings

Figure 4 presents the clustering around 4 and 5 (14 responses each), as a general satisfaction. Nevertheless, the most remarkable was the reaction of a user with the rating of usability 5/5 but stated: It is hard to be used by blind people. This disconnection, personal contentment and knowledge of the exclusion of others, is exactly how the problem of accessibility can remain unseen until it becomes too noticeable to be acted upon.



Overall Usability Rating Distribution (n=32)

E. The Awareness–Inclusivity Gap

Figure 5 shows the most incisive result of the survey: 90.6% of users know about accessibility features (screen readers, font scaling), and only 21.9% of them are of the strong opinion that UPI apps are truly inclusive (Table IV). Valencia-Arias et al. (2025) describe it as the awareness-adoption gap: understanding of the existence of a feature does not convert into the belief in its practical application [10]. In the case of UPI, there is support of screen reading, which is in theory but patchy and uneven in practice.

V. IDENTIFIED ACCESSIBILITY CHALLENGES

A. Screen Reader Failures.

TalkBack (Android) and VoiceOver (iOS) are not features that blind people can opt to use but the only way to use a smartphone. Pervasive labelling failures were detected in all three apps [11]. The screen reader on Paytms login page combined two distinct inputs fields into one incomprehensible command. One of the experienced participants had to guess the purpose of the field based on the type of keyboard presented - a detective workaround that the less experienced users could not get. To a person lacking that kind of background knowledge, the consequence is mere helplessness.

B. Navigation Complexity

The three apps hide key functionalities in menu hierarchies. The process of changing a UPI PIN took at least three levels of menu in all apps tested by Singh et al. (2024); one of the participants took ten minutes to find it in the PhonePe app; another participant only discovered it by chance [11]. The core value of simplicity is also presented by Kang (2018): users should perform essential payment operations without going through complex step-by-step procedures [14]. This was reflected in the responses of the survey participants: The most frequent unsolicited advice was to make it simple and large, clear buttons with Send, Request, and Scan.

C. Ineffective Communication of errors.

In our survey, 18.75% of the respondents rated the clarity of error messages as Neutral or less. The result of Singh et al. (2024) was that participants kept failing to connect bank accounts without feedback on the reason why, just by guessing, they had entered the wrong phone number [11]. Kang (2018) explains that atomicity is a fundamental principle of payment: a transaction should fail or succeed without leaving any traces [14]. The expression on the user side of that same requirement is clear, specific error messages.

D. Absent Multi-modal Feedback.

Audio transaction confirmation was often requested in open-ended answers: Sound of amount deducted from mobile and Instant confirmation via SMS + in-app notification. These are no preference to visually impaired users but necessities. In the absence of audio or haptic feedback, one can not be sure whether a payment has been successful. This is precisely what Kang (2018) predicts: payment systems of the wearable era will have to accept non-visual feedback channels [14], so it will be both an accessibility requirement and a future-readiness requirement.

E. Networking and off-line availability

Unprompted requests by survey respondents were: Lightweight app on slow networks, Faster QR scanning on 2G/3G, and Offline payment options. Kawamoto et al. (2023) recognize access to infrastructure as a basis to the success of payment platforms [12]. The internet-free USSD model of M-Pesa was able to attain almost universal adoption in Kenya specifically because it did not need a smartphone or a trusted data connection. The digital divide in India comprises of disability, connection, and affordability of devices; and addressing accessibility is to address all three items.

VI. COMPARATIVE APP ACCESSIBILITY ANALYSIS

WCAG accessibility scores as reported by Singh et al. (2024) [11] are found in Table V and Figure 6. Google Pay (80.9%) and PhonePe (56.5) have a wide gap between them - about a B grade and a failing mark. The most concerning number is the Perceivable score of 17/35 (49%) of PhonePe: less than half the interface elements are not perceived by other means other than visual. It is not a gap but a structural design failure.

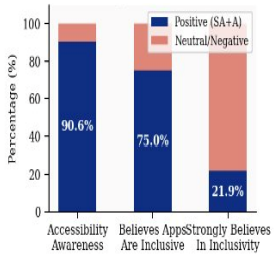


Fig. 5. Accessibility Awareness vs. Inclusive Design Belief Gap (n=32)

TABLE IV. Awareness vs. Inclusive Design Belief

Metric	Positive (SA+A)	Neutral/Neg.
Aware of Accessibility Features	29 (90.6%)	3 (9.4%)
Apps Are Inclusive (Agree+SA)	24 (75.0%)	8 (25.0%)
Strongly Believes Inclusive	7 (21.9%)	—

That difference, between being aware of what the technology can do in theory and yet doubting that the technology has actually been implemented, is what Valencia-Arias et al. (2025) describe as the gap between awareness and adoption: users know what the technology is capable of theoretically, but lack the confidence to believe it has ever been implemented in practice [10]. In the case of accessibility, in particular, it will be a credibility issue that not even the most marketing can cover up. Screen readers are theoretically supported by UPI applications, but only patchily, in an inconsistent manner, and just not sufficiently good to serve the millions of Indians who need it most.

The lowest Perceivable score of only 17 out of 35, or 49 percent, is, perhaps, the most frightening statistic in the whole study, as far as PhonePe is concerned. It implies that less than half of the interface of the app can be even perceived by users who do not have access to it visually. It is one of the holes that cannot be solved with a small update or a new paint job. It embodies a key breakdown of even the most basic of WCAG principles, which is the content should be perceivable to everyone, not just the people who can perceive it.

The relatively better performance of Google Pay is indicative of Google investing more broadly and over a longer period in accessibility infrastructure, i.e. the company has accessibility guidelines to Android developers and has internal audits that most Indian app developers lack the processes to run. Nevertheless, 80.9 remains very far below the 100% mark that true inclusion is supposed to have. The scratch card interface (in which the user is required to actually scratch a graphic with the finger in order to be presented with a reward) is also a compelling demonstration of how even a relatively accessibility-conscious design can fail to address certain scenarios in such a way as to entirely exclude visually impaired users.

VII. DESIGN RECOMMENDATIONS

Our final design advice is summarized in Table VI and is based on our findings in our survey, literature that we have reviewed, and the WCAG 2.0 guidance. The recommendations are linked to the accessibility challenge they are aimed at and the corresponding WCAG success criterion.

TABLE VI. Proposed Accessibility Design Recommendations for UPI Applications

#	Challenge	Recommendation	WCAG / Evidence
R1	Unlabeled UI elements	Add descriptive ARIA labels and alt-text to all buttons, images, and interactive components	1.1.1, 4.1.2; Singh et al. [11]
R2	Complex navigation	Flatten menu hierarchy; expose critical functions (Change UPI PIN, QR Code, Help) on primary screens	3.2.3; Kang [14]
R3	Screen reader	Mandate	All WCAG;

	failures	TalkBack/VoiceOver testing in every release cycle; use automated accessibility linting tools	Singh et al. [11]
R4	Unclear error messages	Provide specific, actionable error descriptions: distinguish PIN errors, network failures, and bank server errors	3.3.1, 3.3.3
R5	No audio feedback	Implement multi-modal transaction confirmation: sound alerts, vibration, and voice announcements for all payment events	1.4.2; Kang [14]
R6	Low contrast UI	Enforce WCAG AA contrast ratio (≥4.5:1 for normal text, ≥3:1 for large text) across all themes and modes	1.4.3
R7	Graphical rewards	Treat scratch cards as labeled buttons; provide screen reader instruction text as alternative to gesture-based interaction	1.1.1, 2.1.1; Singh et al. [11]
R8	Offline/low-connectivity	Develop lightweight app modes for slow networks; implement graceful degradation with informative status messaging	Kawamoto et al. [12]
R9	Biometric barriers	Prioritize fingerprint and face recognition as primary authentication, reducing PIN dependency for motor-impaired users	Kang [14]; Survey
R10	No regulatory standard	NPCI should mandate WCAG 2.1 Level AA compliance for all UPI TPAPs as a condition of certification	Valencia-Arias et al. [10]

VIII. DISCUSSION

UPI has revolutionized mass-scale digital payments and has been unsuccessful behind the scenes in terms of inclusion. Accessibility is not equal to usability. This gap is quantified by our survey; almost half of all general users report having a confused experience with labelling; a quarter of them do not know whether UPI apps are designed to serve all types of users; and only one in five strongly believes that UPI apps are made to serve users with different abilities. Valencia-Arias et al. (2025) locate the same research blind spot in the research literature itself, i.e., mobile payment studies focus on trust and usefulness, but not on the underlying question of whether all members of society are able to actually use these systems [10].

Kang (2018) offers a beneficial analogy: failures in security cannot be observed when the system functions properly, and they are disastrous when they happen, thus necessitating urgent action [14].

The failures of accessibility operate in a different way, as they do not appear to the majority of users, and those affected are the least likely to launch grievances or be covered in the press. They merely give up, or continue to fight. No forcing function. That is why NPCI requiring WCAG 2.1 Level AA compliance as a TPAP certification requirement is not merely a policy recommendation, but rather the sole mechanism that provides a credible incentive to providers to do so.

Suggestions in the survey such as fingerprint payment, offline mode, transaction filters, and easy wrong-transaction reporting are not accessibility requests per se, but all common design enhancements that will benefit users with cognitive, motor, or visual impairments disproportionately. Margins Designing margins enhances the experience of each.

IX. CONCLUSION

The gap between the scale achievement and accessibility reality of UPI is a constant and quantifiable gap as mapped in this paper. Our primary survey of 32 users and synthesis of four major studies reveal: 46.9% of general users report confusion with buttons and labels; 25% do not know whether UPI apps are built to be inclusive; and only 56.5% of the interface components of PhonePe could be perceived by non-visual means [11]. This is not good with an app that is being used to process crores of transactions in a country that houses one third the number of the visually impaired in the world.

Our top ten tips, covering ARIA labelling, simplifying navigation, biometric authentication, multi-modal feedback, and regulatory requirements, will provide a roadmap based on actual usability data and the literature. Three commitments are required to achieve progress: NPCI making accessibility compliance a hard certification criterion; TPAP organisations implementing true user-centred design processes; and accessibility research becoming the norm in mobile payment adoption research instead of the ongoing gap it currently signifies [10][12]. The technology was already in existence. What is required is the will - organisational, regulatory and cultural. India developed UPI to the entire India. It has to be made to look like that as well.

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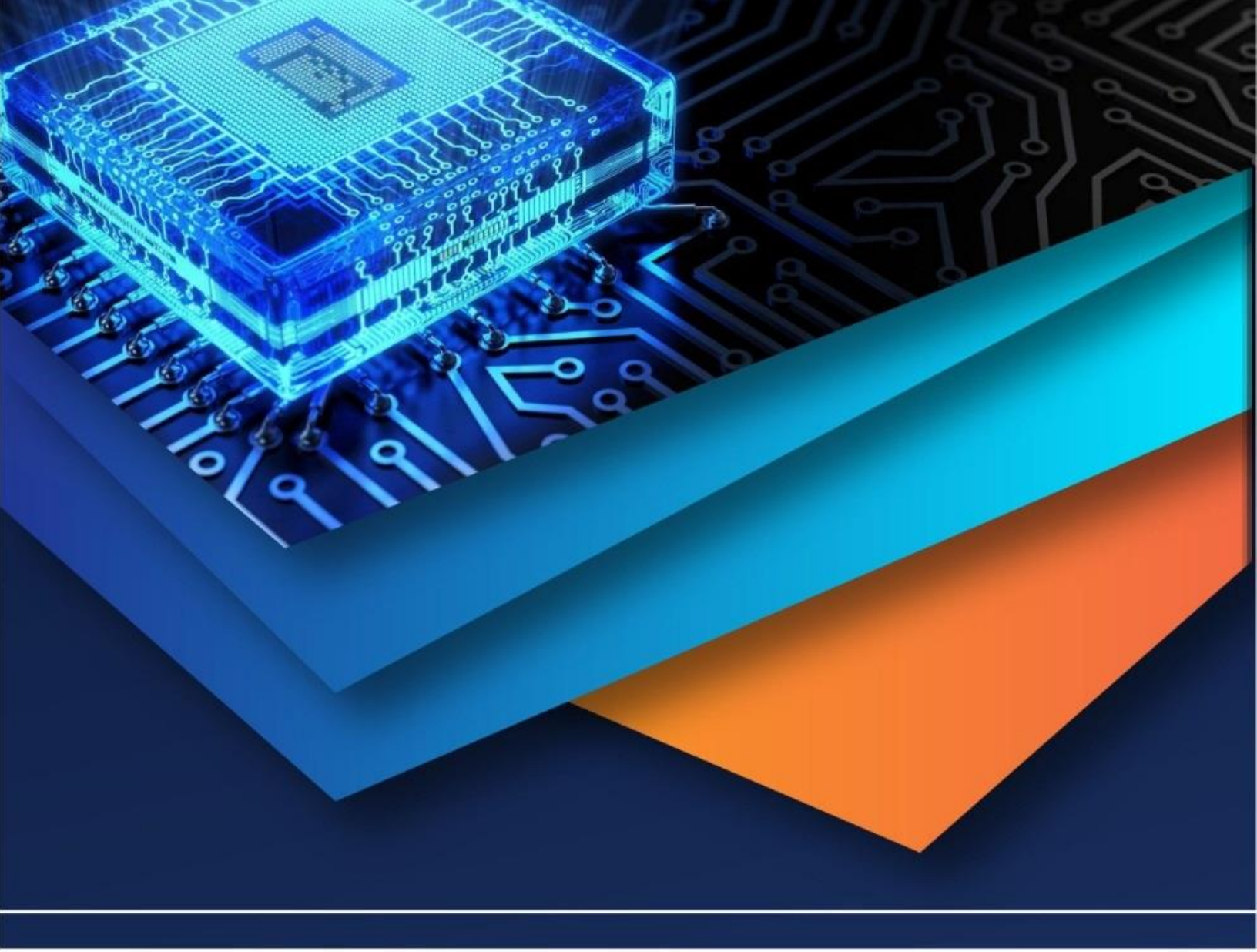

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